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ABSTRACT

An instructor's manual and student activity guide on air conditioning are provided in this set of prevocational education materials which focuses on the vocational area of trade and industry. (This set of materials is one of ninety-two prevocational education sets arranged around a cluster of seven vocational offerings: agriculture, home economics, distributive education, health occupations, world of work, trade and industry, and office occupations.) The instructor's guide is organized into the following elements: title of activity, duration of activity (five to eight periods), activity goals, ten instructional objectives, related vocational clusters, and activity implementation (description, safety precautions, materials needed, teacher preparation prior to class, during the class, follow-up activities, answer key to student check point activities, and masters for duplication). The student activity guide provides step-by-step instructions (narrative and illustrations) for completing each instructional objective. At the end of each set of instructions is a student check point (evaluation activity). Occupational descriptions for heat-transfer technician, air-conditioning-unit tester, and domestic air-conditioning installer conclude the document. (JH)

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ED169371

T & I – AIR CONDITIONING

Kit No. 82

INSTRUCTOR'S MANUAL

Prepared by

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EDUCATION & WELFARE
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TITLE OF ACTIVITY

Kit No. 82, T & I – Air Conditioning

DURATION

Main Activity – 4 to 5 periods
Follow-up Activity – 1 to 3 periods

GOALS

The student will have an understanding of air conditioning problems and their solutions. He/she will troubleshoot an air conditioner mock-up.

INSTRUCTIONAL OBJECTIVES

Each student will identify the major components of an air conditioner.

Each student will identify 5 tools used to service an air conditioner.

Each student will identify three typical plugs and receptacles used with air conditioners.

Given the proper tools and equipment, each student will rewire a crowfoot plug.

Using the proper tools and equipment, each student will rewire a crowfoot receptacle.

Given a continuity tester, a student will check the system for accuracy.

Each student will remove, clean, and replace the air conditioner's air filter.

Each student will straighten the fins on either the evaporator coil or the condenser coil.

The student will test the thermostat for continuity.

The student will replace the thermostat.

VOCATIONAL CLUSTERS

Distributive Education
Health Education
Office Occupations

ACTIVITY IMPLEMENTATION

A. Activity Description

This activity is an individualized activity in which the students will perform preventive maintenance to the air conditioner mock-up. Students will simulate the job of a heating and air conditioning repairperson.

B. Safety

NEVER plug in the mock-up.

Care should be taken using the fin comb to straighten the coil fins. The students could slip and injure their knuckles.

Care should be taken when using the continuity tester.

C. Materials

1. Audio-Visual Equipment
   None
2. Technical Equipment
   13 wiring units
   6 small blade screwdrivers
   6 fin combs
   6 thermostats
   13 medium blade screwdrivers
   6 air conditioner mock-ups
   6 permanent air filter replacements
   6 – 18" rulers
   6 medium phillips head screwdrivers
3. Expendable Supplies
   None

D. Preparation Prior to Class

Reproduce student's check sheet and VIEW Fact Sheet, one per student.

Check tools and equipment required for implementation.

E. During Class Session

INTRODUCTION – This activity is concerned with air conditioning. Many houses and commercial buildings have air conditioners. In order to keep these units operating at highest efficiency, it is necessary to perform some periodic maintenance on them. People involved in this career could be professionals like mechanical engineers, technicians, and skilled people like service repairpersons, installers, and sales personnel. Your activity will carry you through some of the jobs listed above. The activity is concerned with preventive maintenance and minor repair. This could be a large central air conditioning unit or a small window unit. You as the serviceperson will provide the labor in making the repair.

TO THE TEACHER –

Distribute the student check sheet. Explain to the students that the check sheet

must be checked by you before they proceed through the objectives.

Distribute the student activity guides.

Instruct your students to follow the guide and turn in the check sheet as they complete each instructional objective.

The first day will probably be concerned with tool and equipment identification.

The students should take 3 to 4 days for the completion of the maintenance on the mock-ups. It may be advisable to break the class into two groups. One could wire the crowfoot plug and receptacle while the other group worked on the air conditioner mock-ups.

F. Follow-up Activities

1. Each student will do VIEW Fact Sheet.
2. Students will locate jobs related to air conditioning and heating in the want ad of the newspaper or local job placement service.

ANSWER KEY

Instructional Objective I

1. Thermostat
2. Air Filter
3. Evaporator Coil
4. Plug
5. Condenser Coil
6. Control Panel
7. Fan
8. Blower
9. Compressor

Instructional Objective II

1. Continuity Tester
2. Phillips Head Screwdriver
3. 18 inch ruler
4. Blade Screwdriver
5. Needle Nose Pliers
6. Fin Comb

Instructional Objective III

1. Tandem
2. Crowfoot
3. Parallel

MASTERS FOR DUPLICATION

VIEW Fact Sheet
Student Check Sheet

VIEW FACT SHEET

NAME _____ CLASS _____ OCCUPATION _____

A. List the advantages (good points) of this occupation (job).

B. List the disadvantages (bad points) of this occupation (job).

C. List three things you should know to do this occupation (job).
1.
2.
3.

D. What type of education should you get to be prepared (do) for this occupation (job)?

E. What courses must you take to go into this occupation (job)?

F. What do you think your future in this occupation (job) will be?

G. What wage can you expect in this occupation (job)?

H. What are the working hours of this occupation (job)?

I. To learn more about this occupation (job), write to:

J. Using a scale of 1 to 5, circle the number that measures your interest in this occupation (job) as a possible career.

I don't like it. 1 2 3 4 5 I like it.

STUDENT CHECK SHEET

Instructor's Initials

Objective No. 1 Equipment Identification _____

Objective No. 2 Tool Identification _____

Objective No. 3 Plug Identification

(1) _____ _____

(2) _____ _____

(3) _____ _____

Objective No. 4 Plug Wiring _____

Objective No. 5 Receptacle Wiring _____

Objective No. 6 Continuity Tester _____

	Check One	
	lights on	lights off
green wire	[ ]	[ ]
white wire	[ ]	[ ]
black wire	[ ]	[ ]

Objective No. 7 Cleaning the Air Filter _____

Objective No. 8 Comb Fins _____

Objective No. 9 Continuity Test of Thermostat _____

Objective No. 10 Replace Thermostat _____

T & I – AIR CONDITIONING

Kit No. 82

STUDENT
LEARNING ACTIVITY GUIDE

Prepared by

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INTRODUCTION

This activity is concerned with air conditioning. Many homes and businesses have air conditioning units, and all of them require periodic maintenance to keep them operating efficiently and to extend their useful operating life. People involved in this career are professionals like mechanical engineers or technicians such as service repairpeople, installers, and sales personnel. This activity will demonstrate some of the jobs listed above. This activity is concerned with preventive maintenance and air conditioning minor repairs. Repairs could relate to a large central air conditioning unit or a small window unit. Each student will act as a serviceperson and will provide minor repairs to a mock-up unit.

GOALS

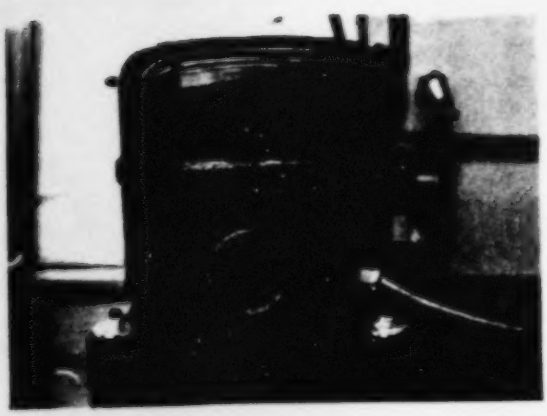
Each student will have an understanding of some of the service problems within an air conditioning unit.

Each student will provide minor maintenance to a mock-up unit.

Instructional Objective 1

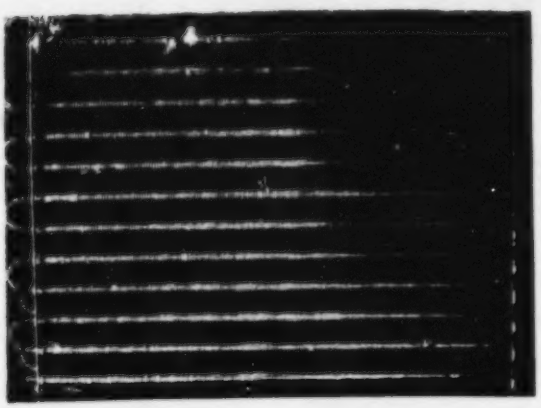
Each student will identify the major components of an air conditioner.

STEP 1 – The condenser coils cool the air passing over them.



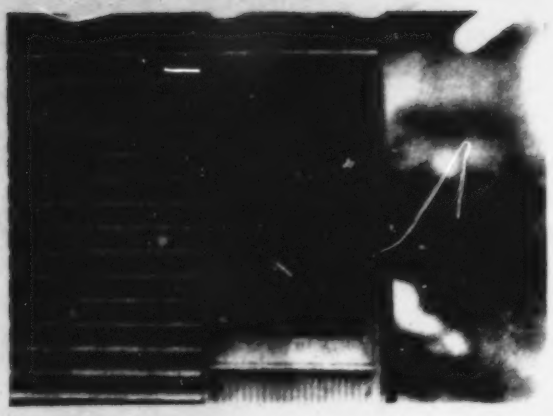
STEP 2 – The compressor pressurizes the refrigerant liquid and circulates it through the coils.

STEP 3 – The condenser fan circulates air through the condenser coils.

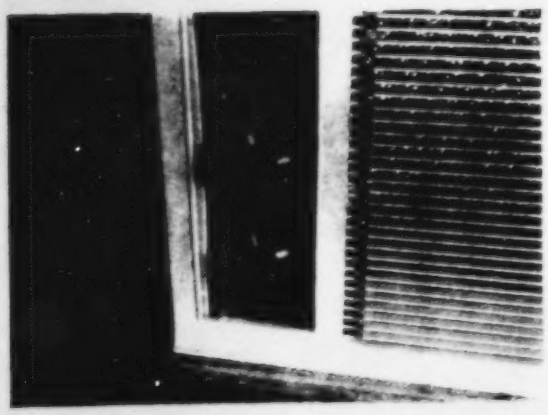


STEP 4 – Evaporator coils are used to absorb heat from air in the room.

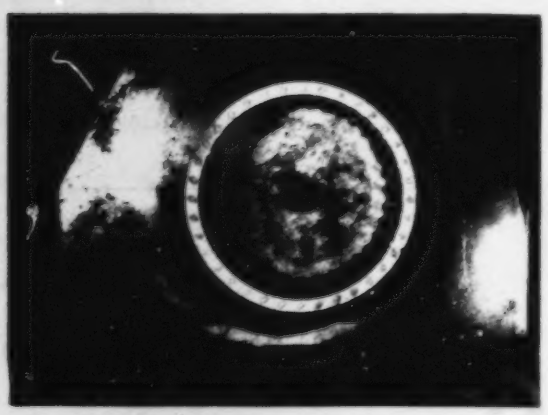
STEP 5 – The permanent air filters remove impurities (dirt) from the air.



STEP 6 – The control panel is used for selecting different fan speeds.



STEP 7 – The thermostat allows you to select a comfortable room temperature.

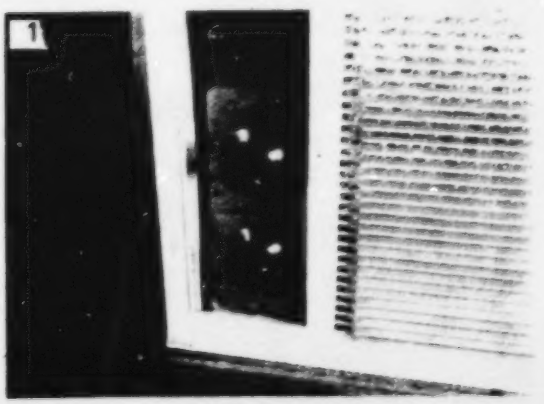


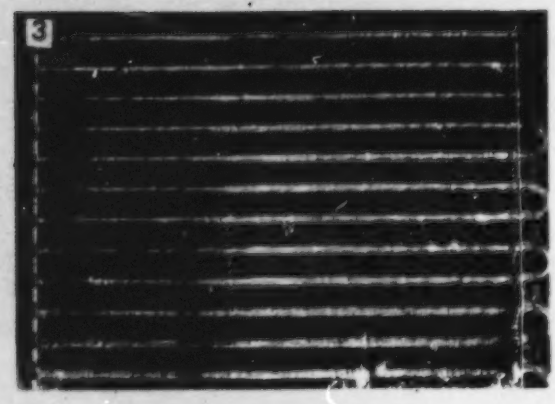
STEP 8 – The blower directs cool air into the room.

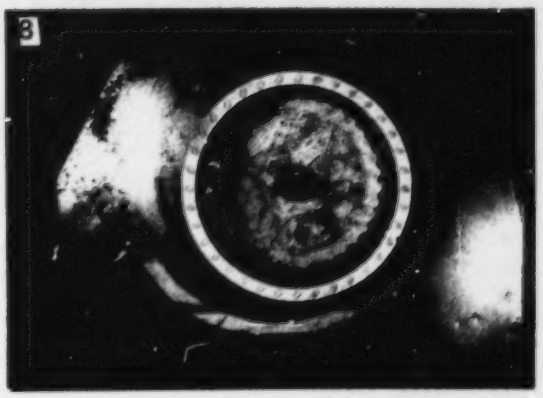
STEP 9 – The plug provides the connection to operate the unit from a power source.

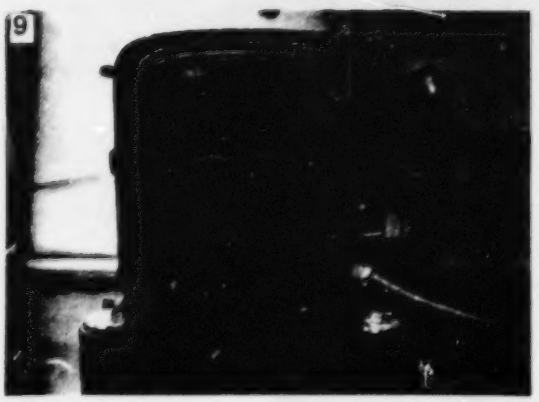
Check Point

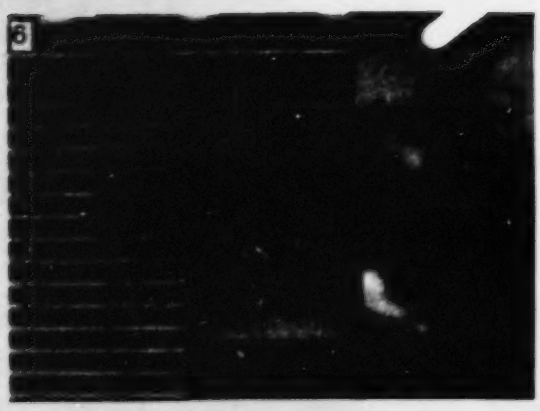
On a separate sheet of paper, list 1–9 and identify the following components of the air conditioner. Turn in the completed sheet to your instructor. Have your instructor initial your check sheet.







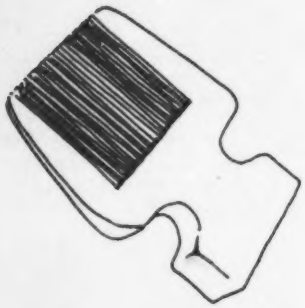




Instructional Objective II

Each student will identify tools used to service an air conditioner.

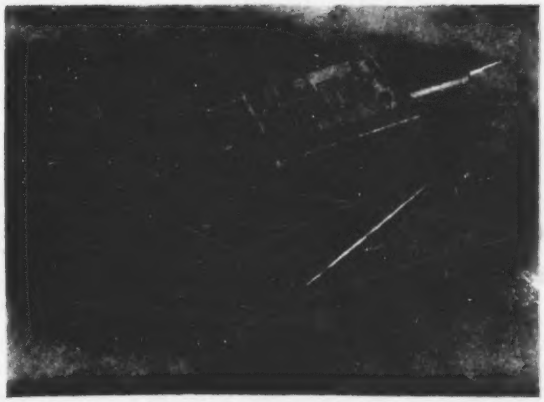
STEP 1 — This is a phillips head screwdriver. It is used to turn screws with a cross-point head.



STEP 2 — The fin comb is used to straighten bent coil fins.

STEP 3 — Blade screwdriver is sometimes called a common screwdriver. It is used on screws with one slot across the head.

STEP 4 — An 18" ruler is used in English measurement.



STEP 5 — Continuity tester checks the flow of electricity in a circuit.

STEP 6 — Needle nose pliers.

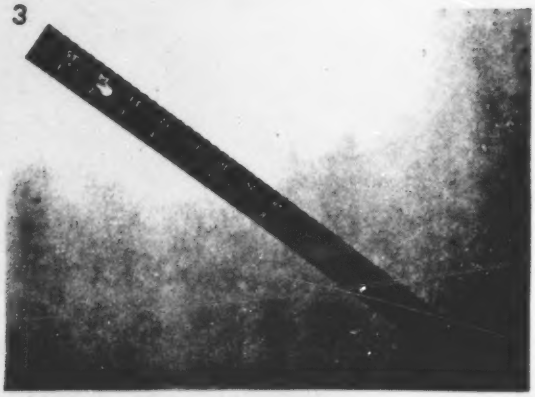
Check Point

On a separate sheet of paper, list 1-6 and identify the following tools. Return the sheet to your instructor. Have your instructor initial your check sheet.

1

2

3



4

5

6

Instructional Objective III

Each student will identify three typical plugs and receptacles used with air conditioners.

(1) parallel,

(2) tandem,

(3) and crowfoot.

STEP 1 — The three types of plugs and receptacles are parallel, tandem, and crowfoot.

Using the check sheet for Objective No. 3, identify the three types of plugs and receptacles and have your instructor initial your check sheet.

1

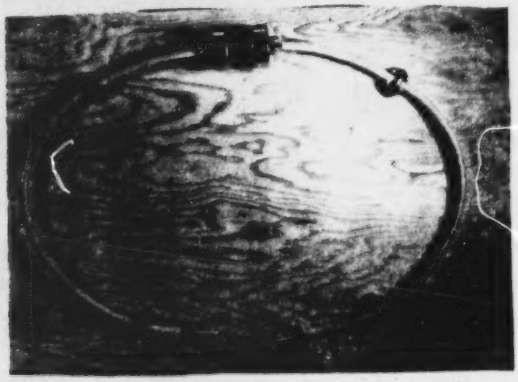
2

3

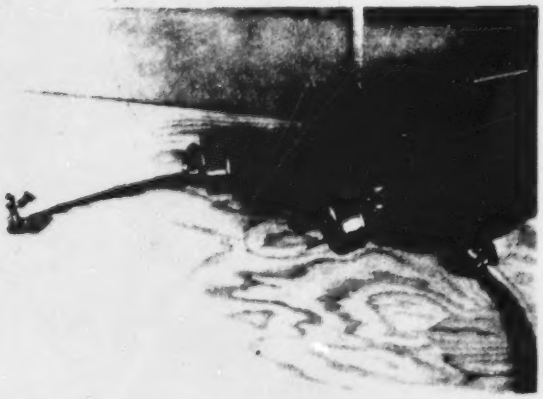
Instructional Objective IV

Given the proper tools and equipment, each student will rewire a crowfoot plug.

STEP 1 – Obtain a blade screwdriver and needle-nose pliers.



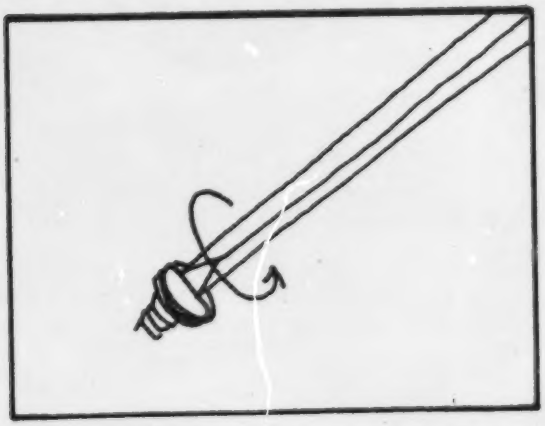
STEP 2 – Obtain a sample wiring board.



STEP 3 – Unscrew both clamp screws located at the neck of the plug.

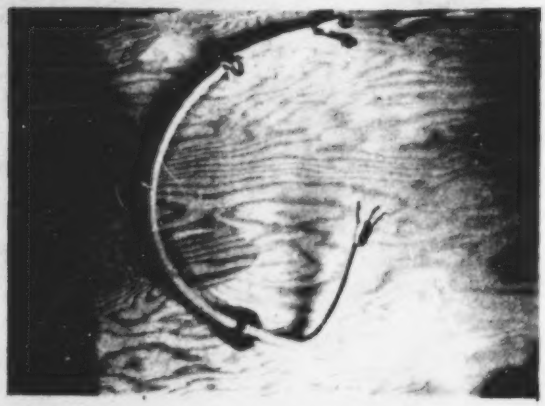
STEP 4 – Turn the prongs of the plug toward you and pull off the plastic cover.

STEP 5 – Look at the three different colored screws. They each have a colored wire attached to them. The silver screw has a green wire; the copper screw has a black wire; and the brass screw has a white wire.



STEP 6 – Unscrew, by turning counterclockwise, all three screws, releasing the wires.

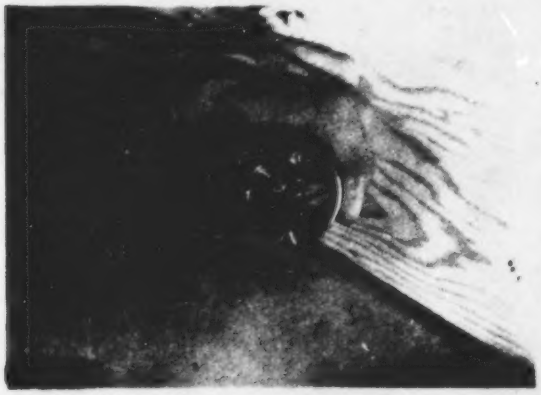
STEP 7 – Pull the main cable from the plug.



STEP 8 – Locate the new line on your work board.

STEP 9 – Slide the new cable through the clamp on the neck of the plug.

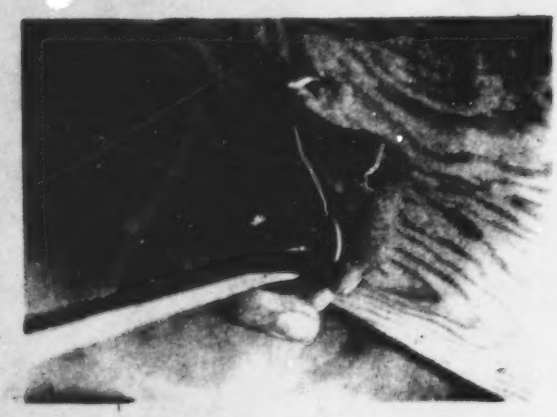
STEP 10 – Be sure all the ends of wire are together, not frayed, and are bent in a hook shape.



STEP 11 – Place the green wire around the silver screw, making certain the wire is bent in a clockwise direction around the screw.

STEP 12 – Tighten the silver screw in a clockwise direction, securing the green wire.

STEP 13 – Place the black wire around the copper screw; be sure the wire is bent in a clockwise direction around the screw.

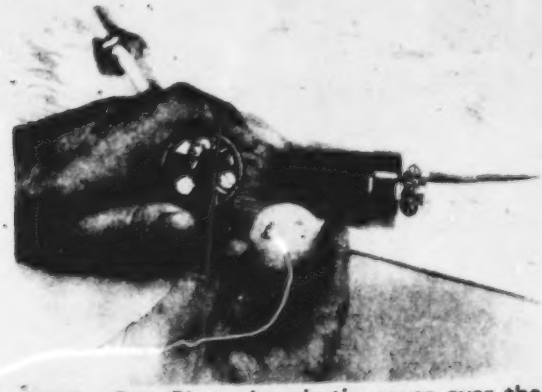


STEP 14 – Tighten the copper screw in a clockwise direction, securing the black wire.

STEP 15 – Place the white wire around the brass screw; be sure the wire is bent in a clockwise direction around the screw.

STEP 16 – Tighten the brass screw in a clockwise direction, securing the white wire.

STEP 17 – Tighten both clamp screws located on the neck of the plug.



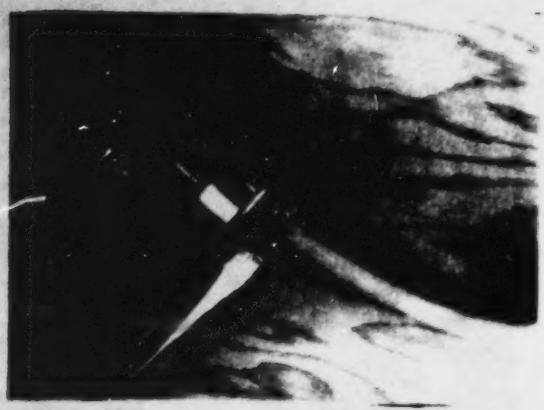
STEP 18 – Place the plastic cover over the prongs of the plug.

Check Point

Be sure no wire is touching any other screw; green to silver, white to brass, and black to copper. Loose connections will cause accidents. Place the plastic cover over the plug prongs. Have your instructor initial your check sheet.

Instructional Objective V

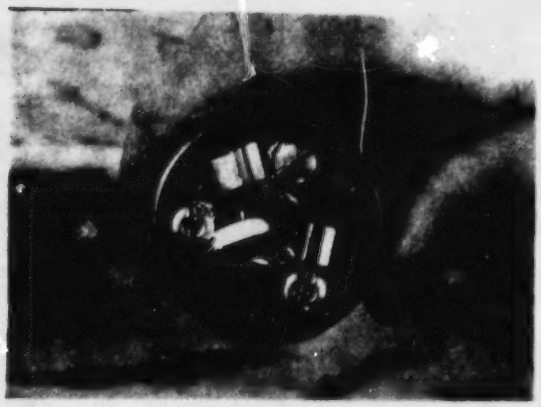
Using the proper tools and equipment, each student will rewire a crowfoot receptacle.



STEP 1 – Loosen both clamp screws located at the neck of the receptacle.

STEP 2 – Using a small blade screwdriver, remove the three cover screws on the front of the receptacle.

STEP 3 – Remove the receptacle cover.



STEP 4 – Observe three screws: one silver and two brass.

STEP 5 – Unscrew all three screws releasing the green, black, and white wires.

STEP 6 – Pull the wire through the clamp to remove the receptacle from the system.

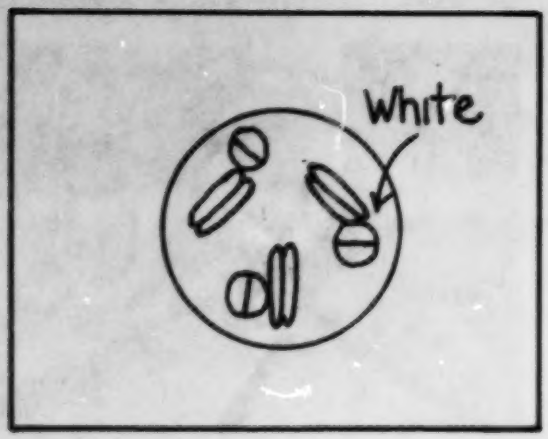
STEP 7 – Locate the new line on your work board.

STEP 8 – Slide the new cable through the clamp of the neck of the receptacle.

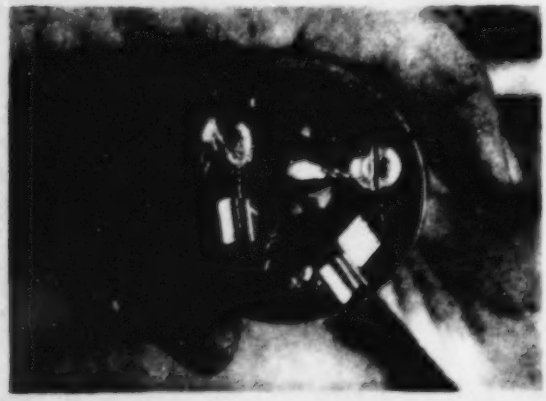
STEP 9 – Be sure all the ends of wire are together, not frayed, and bent in a hook shape.

STEP 10 – Place the green wire around the silver screw; be sure the wire is bent in a clockwise direction around the screw.

STEP 11 – Tighten the silver screw in a clockwise direction, securing the green ground wire.

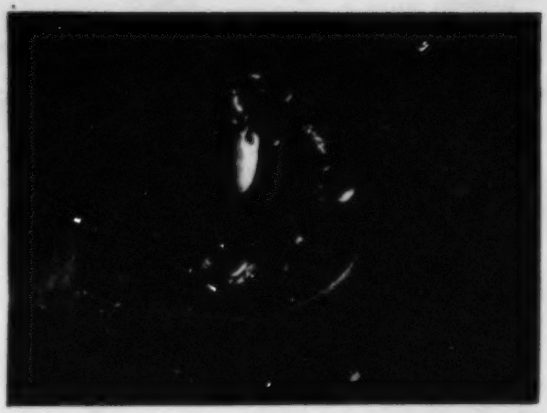


STEP 12 – The remaining two wires will both carry current. They are considered hot wires. Hold the crowfoot in this position to locate the correct placement of the white wire.

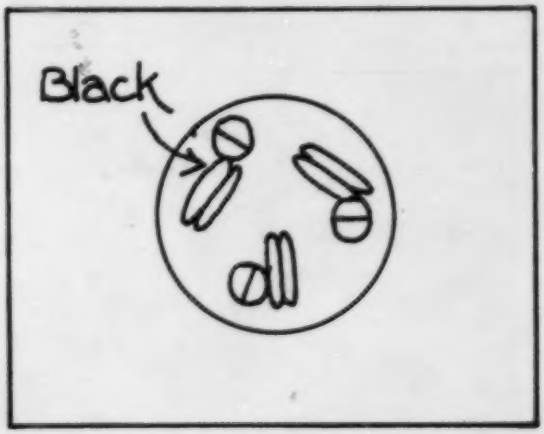


STEP 13 – The white wire will attach to the upper right brass screw.

STEP 14 – Place the white wire around the brass screw bent in a clockwise direction.



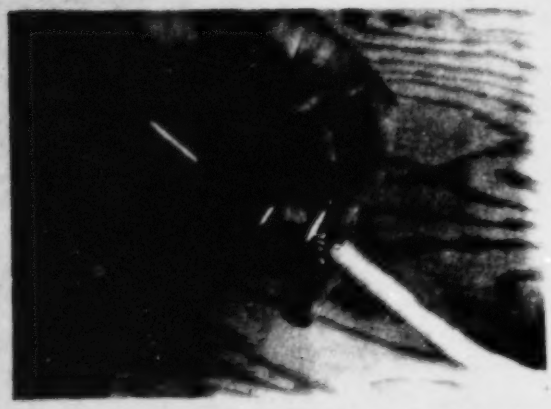
STEP 15 – Tighten the brass screw to secure the white wire.



STEP 16 – Place the black wire around the top-left brass screw, bent in a clockwise direction.

STEP 17 – Tighten the brass screw to secure the black wire.

STEP 18 – Check all wires for proper fit around the screws. If any wire is not fastened properly, correct it now. Failure to wire plugs or receptacles properly will cause accidents and injury.



STEP 19 – Place the plastic cover over the receptacle.

STEP 20 – Using the small blade screwdriver, tighten the three cover screws on the receptacle.

STEP 21 – Tighten both clamp screws on the neck of the receptacle.

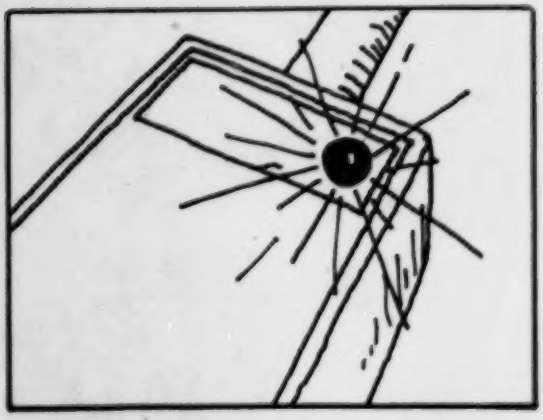
Check Point

Ask your instructor to review your progress and initial your check sheet.

Instructional Objective VI

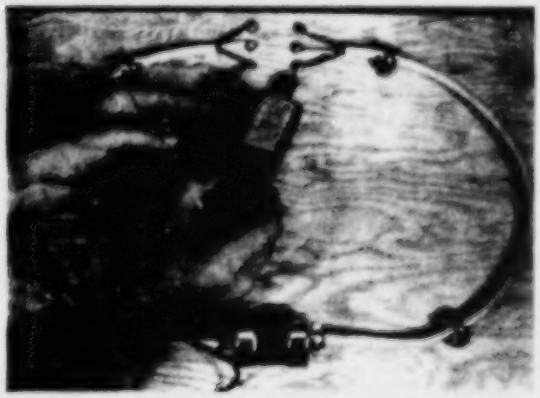
Given a continuity tester, a student will check the system for accuracy.

STEP 1 – Obtain a continuity tester from the instructor.

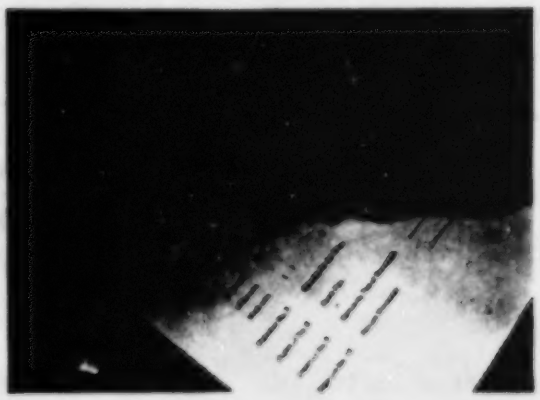


STEP 2 – If your wiring system is accurate, wires of the same color should activate the light of the continuity tester when the plug is connected.

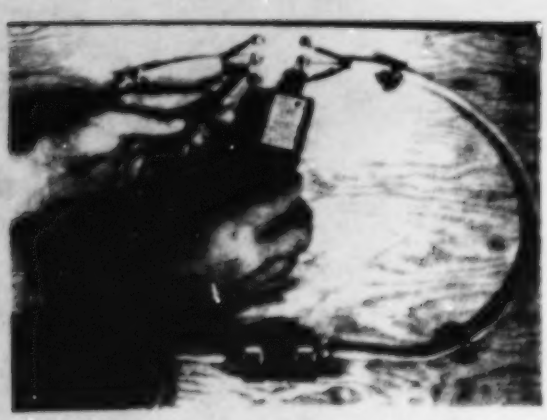
STEP 3 – Turn on switch of the tester.



STEP 4 – Place one probe on the left green wire and the other probe on the right green wire.



STEP 5 – Write down the tester reaction on your check sheet.



STEP 6 – Place one probe on the left white wire and the other probe on the right white wire.

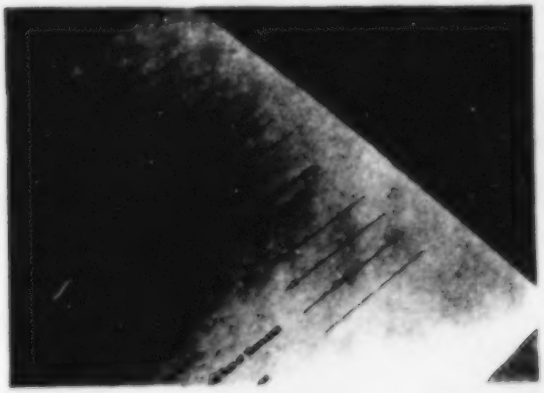
STEP 7 – Write down the tester reaction on your check sheet.

STEP 8 – Place one probe on the left black wire and the other probe on the right black wire.

STEP 9 – Record the tester reaction on your check sheet.

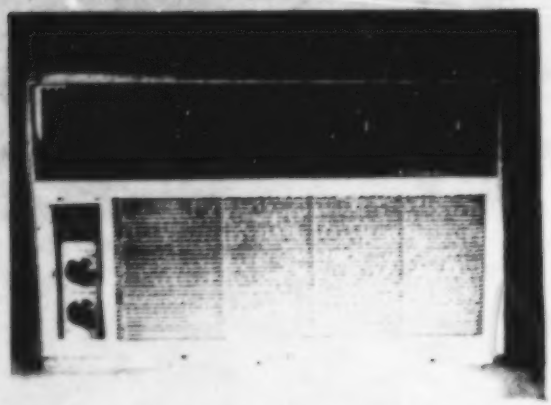
Check Point

Have your instructor initial your check sheet.

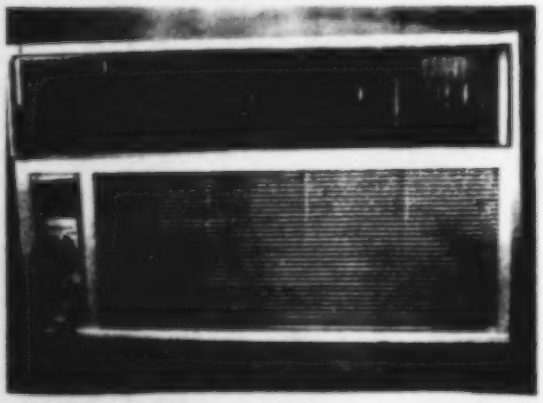


Instructional Objective VII

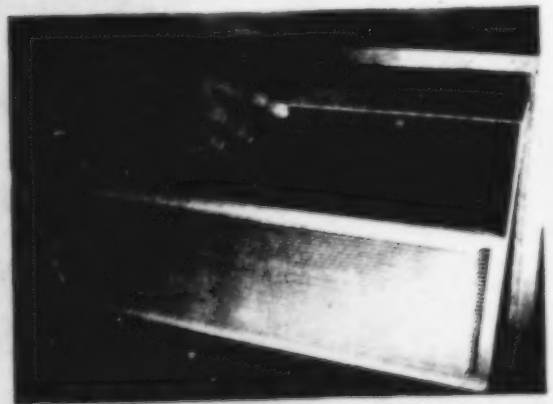
Each student will remove, clean, and replace the air conditioner's air filter.



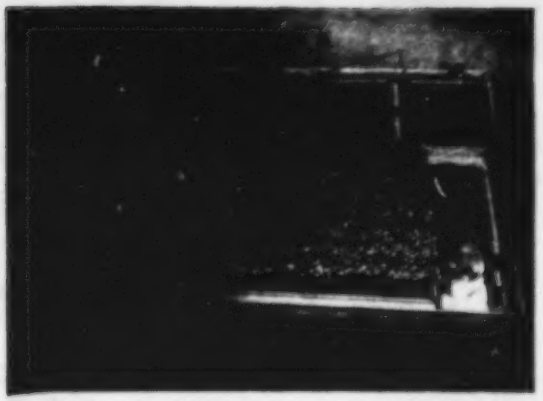
STEP 1 – Secure the air conditioner mock-up.



STEP 2 – Remove both plastic control knobs by pulling them toward you.



STEP 3 – To remove the air conditioner cover, gently pull forward towards you and lift up.

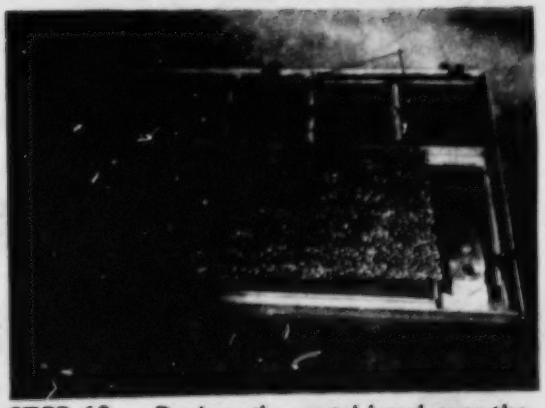


STEP 4 – Unclip the metal band holding the air filter and lift it up.

STEP 5 – Remove the air filter.

STEP 6 – Go to a sink and turn the water on at a fast rate.

STEP 7 – Saturate the air filter by holding it under the running water.



STEP 10 – Replace the metal band over the edge of the cover.

STEP 8 – Place the filter on a flat surface to dry.

Check Point

Have your instructor check the unit and initial your check sheet.

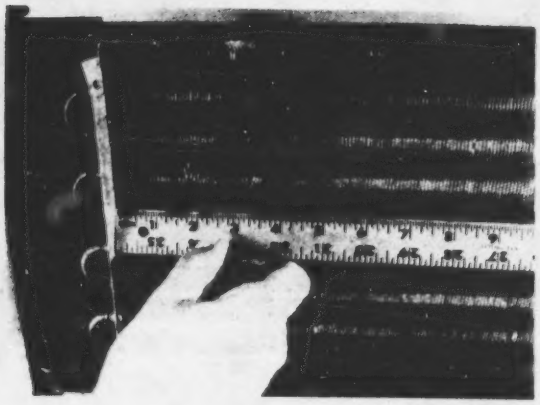
STEP 9 – Replace the filter in the air conditioner.

Instructional Objective VII

Each student will straighten the fins on either the evaporator coil or the condenser coil.

STEP 1 – Obtain the 18" ruler and the fin comb.

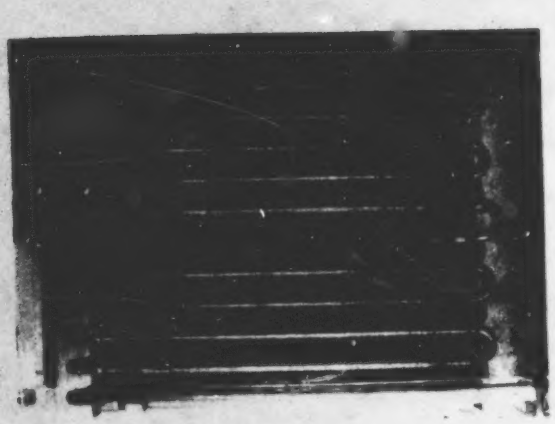
STEP 2 – Locate either the evaporator or condenser coil.



STEP 3 – Measure either coil and count the number of fins in one inch.

STEP 4 – Take the fin comb with the correct number of teeth per inch and place it at the top of the coil.

STEP 5 – Pull the fin comb down, straightening the fins.



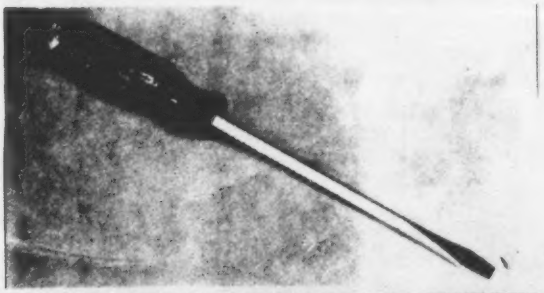
STEP 6 – Repeat this process until all the fins are straight.

Check Point

Have the instructor check the fins and initial your check sheet.

Instructional Objective IX

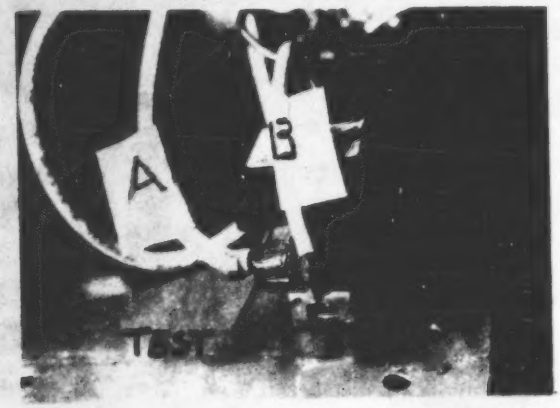
Each student will test the thermostat for continuity.



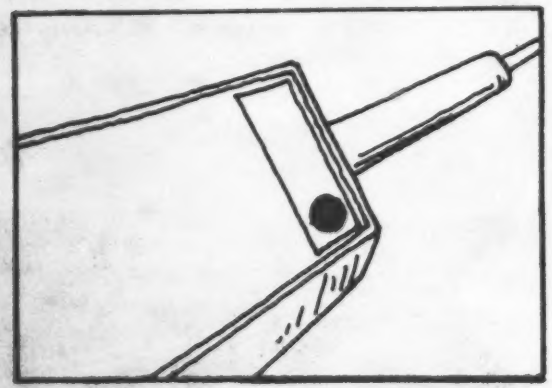
STEP 1 – Obtain the continuity tester and common screwdriver.

STEP 2 – Remove the two screws holding the control panel to the air conditioner frame.

STEP 3 – Disconnect the power supply by pulling the connector tabs.



STEP 4 – Attach the continuity tester to points A and B.



STEP 5 – The tester should not light at the warmest setting; at the coldest setting, the light should light.

Check Point

Did you determine that you need to replace the thermostat? Have your instructor initial your check sheet.

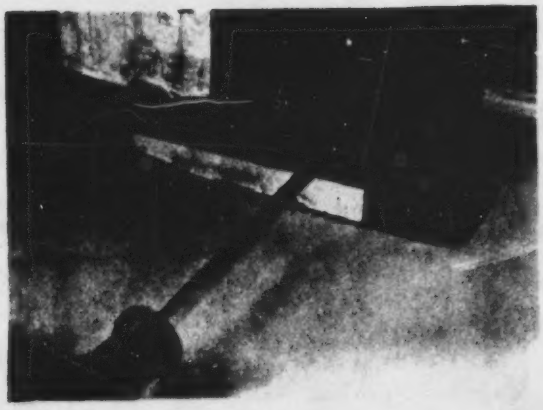
Instructional Objective X

Each student will replace the thermostat.

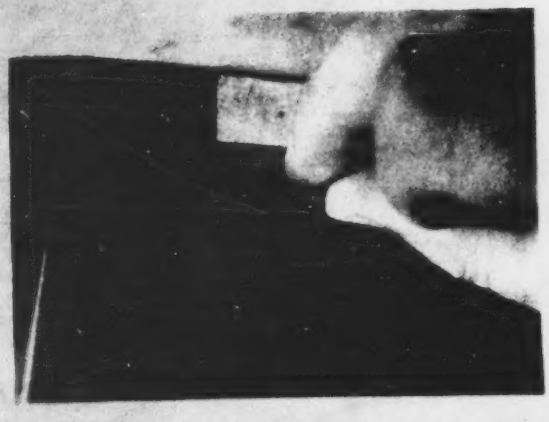
STEP 1 – Remove the mounting screws.

STEP 2 – Pull off the thermostat control box.

STEP 3 – Obtain a new thermostat from your instructor.

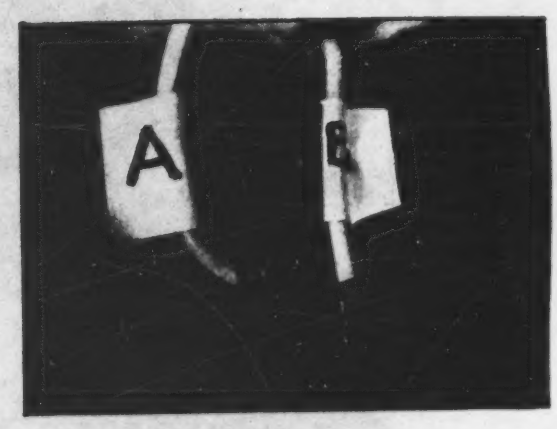


STEP 6 – Tighten the set screws.



STEP 4 – Place the new thermostat in place, aligning the set screws.

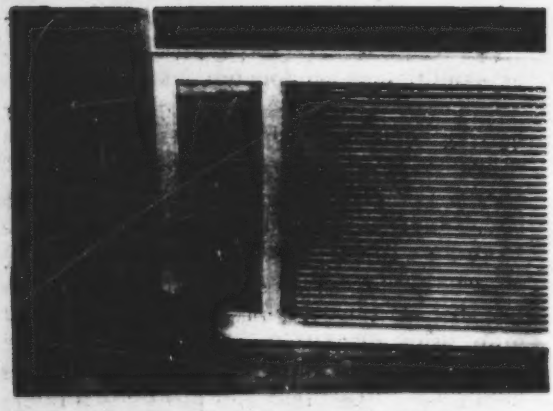
STEP 7 – Replace the two screws holding the control panel in place.



STEP 5 – Replace wires A and B.

STEP 8 – Replace the dry air conditioner filter.

STEP 9 — Replace the air conditioner cover.



STEP 10 — Replace the control knobs.

Check Point

Have your instructor examine the assembled unit and initial the check sheet.

007.181-010 HEAT-TRANSFER TECHNICIAN (profess. & kin.)

Plans requirements for fabricating, installing, testing, and servicing climate control and heat transfer assemblies and systems to assist engineering personnel, utilizing knowledge of heat transfer technology and engineering methods: Calculates required capacities for equipment units of proposed system to obtain specified performance and submits data to engineering personnel for approval. Studies supplier catalogs and technical data to recommend equipment unit selections for system. Prepares unit design layouts and detail drawings for fabricating parts and assembling system. Estimates cost factors, such as labor and material for purchased and fabricated parts, and costs for assembling, testing and installing in customer's premises. Fabricates non-standard parts for system, using metalworking machinery and assembles system, using handtools and power tools. Installs test fixtures, apparatus, and controls and conducts operational tests under specified conditions. Analyzes test data and prepares report for evaluation by engineering personnel. Installs system in customer premises and tests operational performance for compliance with contract specifications and applicable codes. Diagnoses special service problems of systems under service contract and writes instructions for service or repair personnel. May be designated according to specialty as AIR-CONDITIONING TECHNICIAN (profess. & kin.); HEATING TECHNICIAN (profess. & kin.); REFRIGERATING TECHNICIAN (profess. & kin.).

827.361-010 AIR-CONDITIONING-UNIT TESTER (refrigerat. equip.)

Tests efficiency of heating and air-conditioning equipment under simulated operating conditions: Connects heating and air-conditioning equipment to facilities, such as heating units, waterlines, and spray devices to set up controlled temperature and moisture conditions. Constructs cardboard air ducts and other accessories for use in testing equipment. Couples gages and instruments to system and starts equipment. Observes and records readings of instruments, such as thermometers, psychrometers, thermocouples, air flowmeters, voltmeters, ammeters, and pressure and draft gages. Informs supervisor of unusual noise and instrument readings during operation of equipment. May plot instrument reading data.

827.464-010 AIR-CONDITIONING INSTALLER, DOMESTIC (any ind.) air-conditioning-window-box installer

Installs window- or central-air-conditioning units in private residences and small business establishments: Inspects existing wiring, fuses, or circuit-breaker panels on customer's premises to insure adequate power supply for operating air conditioner. Measures window, transom, or other existing openings for air-conditioning unit, using measuring tape or rule, or cuts opening through wall, using mallet and cold-chisel. Assembles and positions support brackets in place, using screws, clamps, and other braces, and handtools and power tools. Fills space between window support and edge of opening with calking compound and filler board. Places air conditioner on support frame and secures unit in position, leveling unit with screws, clips, and bolts. Starts unit, adjusts controls, and listens for excessive noise or sounds indicating malfunction. May give instructions to customer regarding operation and care of unit. May change filters, lubricate machine, replace fan motor or fan belt, and make minor adjustments. May specialize in installation of central units and be designated CENTRAL-AIR-CONDITIONING INSTALLER (any ind.).